

(19) FRENCH REPUBLIC

NATIONAL INSTITUTE  
OF INDUSTRIAL PROPERTY

PARIS

(11) Publication No.:  
(only to be used for ordering copies)

2 737 767

(21) National Registration No

95 09625

(51) IPC<sup>2</sup>: F 17 C 13/12, 13/08

(12)

## PATENT APPLICATION

A1

(22) Filing date: 8/8/95

(23) Priority:

(43) Date application made available to the public:  
2/14/97 Bulletin 97/07

(56) List of documents cited in the preliminary search report:  
This report had not been performed at the date of the  
publication of the application

(60) References to other related national documents:

(71) Applicant(s): SIGMATIC INGENIERIE  
SOCIETE A RESPONSABILITE  
LIMITEE - FR

(72) Inventor(s): PIERRE BERGER and  
GILLES HOVHANESSIAN

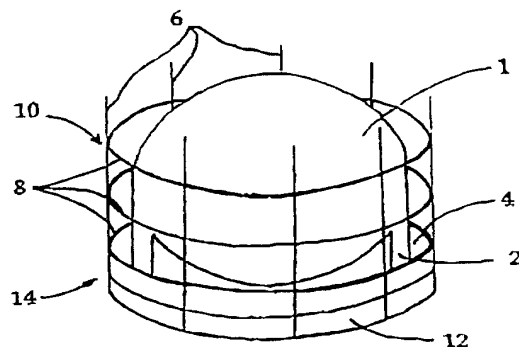
(73) Holder(s):

(74) Representative: LERNER AND ASSOCIATES

(54) DEVICE FOR PROTECTING AERIAL RESERVOIRS INTENDED FOR THE STORAGE OF INFLAMMABLE MATERIALS

(57) The invention is relative to a method for protecting  
above-ground reservoirs (1) intended for storing explosive or  
inflammable materials, in particular liquefied gases.

The device comprising a dense and inert material (4)  
such as earth or sand arranged around the reservoirs (1) is  
characterized in the case of the invention in that it also  
comprises a casing (14) surrounding this dense and inert  
material (4).



The invention is relative to a device for protecting above-ground reservoirs intended for storing explosive or inflammable materials, in particular liquefied gases.

The invention has the problem of protecting reservoirs against risks of explosion by insulating them from the outside, that is it say, to offer them a good thermal resistance, especially against fire, to increase their mechanical resistance to external assaults and to reduce the consequences to the environment in the case of an incident or an accident to the reservoir.

It is already known that the using of a dense and inert material such as earth or sand covering a reservoir is well-suited for this type of protection. In fact, these materials have a great ability to absorb energy and do not change over time, nor do they react with the inflammable or explosive materials stored. However, the solutions known up to the present for implementing this material are either relatively expensive as they necessitate the addition of fibers in order to give the inert and dense material a consistency that permits it to surround the reservoir, or are very bulky and not very resistant in the instance in which a simple slope is realized under which the reservoir is buried.

The device of the invention is characterized in that it also comprises a casing surrounding the dense and inert material. This solution thus effectively contributes to the safety, is easy to implement and responds well to the requirements of the problem posed. In fact, the casing realized around the reservoir permits on the one hand the obtention of a substantially constant thickness of the dense and inert material, which permits the obtention of a reasonable bulkiness, and on the other hand constitutes a second barrier that is very resistant to fire (thermal aggression) and to shocks (consequence of an explosion).

## 2

According to another characteristic of the invention the casing comprises a structure constituted by posts anchored in the ground and connected together by hoopings in order to receive the horizontal thrust exerted by the dense and inert material. It is possible to fix on this structure either a series of panels consisting of non-flammable and resistant material such as concrete and traversed by the hoopings or connected to each other by anchoring means, or a metallic trellis that is then covered by concrete or an equivalent. This solution has the advantage of obtaining a structure that is autostable because it is secured on the ground by means of the posts and robust because the forces of the horizontal thrusts are received by the hoopings. In addition, it has various embodiments that permit the improving of the simplicity of its implementation or the robustness of the device as a function of the intended purpose.

According to another characteristic of the invention the casing comprises elementary blocks such as very large, resistant bricks, e.g., consisting of concrete, at least certain ones of which are arranged in fives, connected by bars traversing them. The unit is placed on the ground and can be prestressed. This solution is simple, easy to implement and also relatively inexpensive since the elementary blocks are realized in a great number.

Other characteristics and advantages of the invention will be apparent from the following description made referring to the attached drawings given by way of example.

Figure 1 shows a first embodiment of the invention.

Figure 2 shows a second embodiment of the invention.

Figure 3 shows a section of a variant in accordance with the first embodiment.

Figure 4 is a top view of the variant of figure 3 along line IV-IV in figure 3.

Figure 5 is a sectional view of another variant in accordance with the first embodiment.

Figure 6 is a top view of the variant of figure 5 along line VI-VI in figure 5.

Figure 7 is a partial view of a third embodiment.

Figure 8 is a partial top view of figure 7.

Figure 1 shows reservoir 1 intended for the storage of inflammable materials, here a sphere resting on the ground via feet 2. Posts 6 planted in the ground and connected among themselves by hoopings 8 are arranged around this sphere 1 and the unit constitutes autostable structure 10. These posts 6 are realized either in reinforced concrete or in steel profiles covered with concrete. In fact, due to the thermal stresses to which they are subjected, the steel runs the risk of melting if it is not covered by a sufficient thickness of concrete or at least by a material thermally and mechanically resistant or protective.

This figure shows a first embodiment in the course of being assembled. Prefabricated panels 12 realized in concrete are fixed on autostable structure 10. A dense and inert material 4 such as earth or sand is arranged between the unit constituted by posts 6, hoopings 8 and prefabricated panels 12 forming casing 14 and between sphere 1.

Hoopings 8 fit either into panels 10 in order to increase the robustness of the unit or behind them as illustrated in figures 5, 6 for the sake of simplicity. Figures 3, 4 respectively show in section and in a top view prefabricated panels 12 descending to ground 16 and traversed by hoopings 8. Figures 5, 6 respectively show in section and in a top view prefabricated panels 12 descending to ground 16 and connected to the hoopings by anchoring means such as hooks 24. The action of the hoops opposes the horizontal thrusts exerted on the casing by dense and inert material 4.

## 4

When the first embodiment is completely assembled, prefabricated panels 12 are arranged up to the top of posts 6 and dense and inert material 4 arranged inside casing for 10 constituted by prefabricated panels 12 completely covers sphere 1.

Figure 2 shows a second embodiment of the invention in which casing 14 still retains dense and inert material 4 around sphere 1. In order to better understand the device of the invention, just as in the case of figure 1, the dense and inert material is not shown entirely covering the sphere as would be the case strictly speaking. In this second embodiment casing 14 comprises a metallic trellis fixed on autostable structure 10 constituted by posts 6 and hoopings 8 as shown in figure 1. Concrete or an equivalent synthetic material is then projected onto the metallic trellis that then functions as a reinforcement.

Figure 7 partially shows a third embodiment consisting of a structure comprising elementary blocks 18 with a parallelepipedic shape made of concrete, placed on the ground, arranged in fives and traversed by bars 20. This structure, that is very simple in design, can be readily varied in order to obtain different dimensional characteristics. In order to facilitate understanding, the distance between the different elementary blocks 18 was increased in this figure. In practice, they are close to each other in order to suitably contain dense and inert material 4.

**5**

Figure 8 shows the structure of figure 7 in a top view and connected by anchoring means 24 to a cable prestressing it in order to better oppose the forces imposed by dense and inert material 4 on structure 10.

**CLAIMS**

1. A device for protecting above-ground reservoirs (1) intended for storing explosive or inflammable materials, in particular liquefied gases, comprising a dense and inert material (4) such as earth or sand arranged around the reservoir (1), characterized in that it also comprises a casing (14) surrounding this dense and inert material (4).

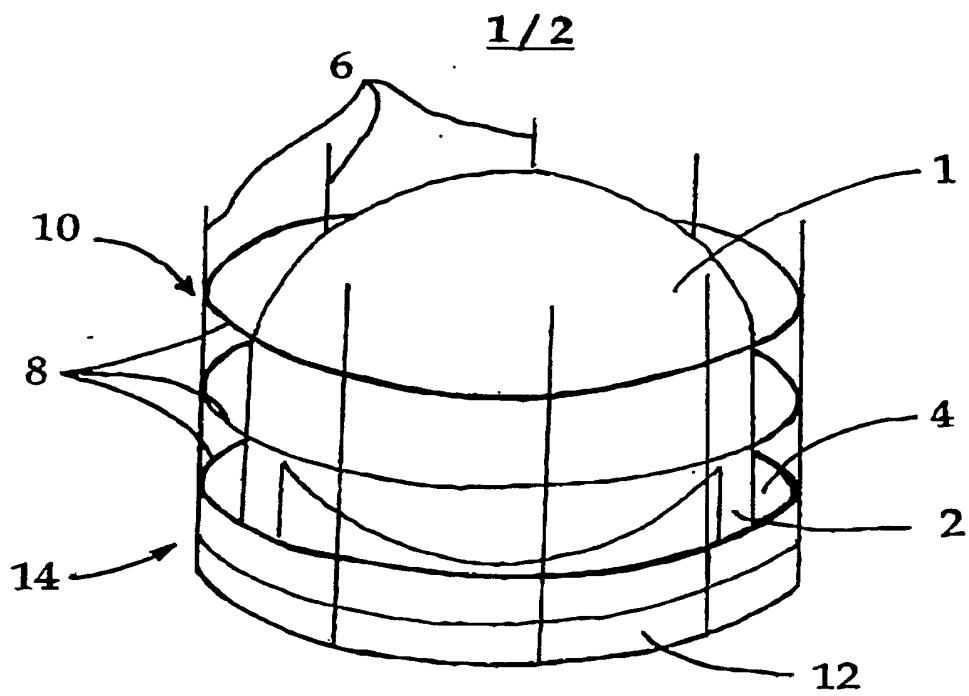
2. The device according to Claim 1, characterized in that the casing (14) comprises a series of adjacent panels (12) consisting of non-flammable and resistant material such as concrete, which panels are carried by posts (6) anchored in the ground and traversed by hoopings (8) joining the posts (6) to each other.

3. The device according to Claim 1, characterized in that the casing (14) comprises a series of adjacent panels (12) consisting of non-flammable and resistant material such as concrete, which panels are carried by posts (6) anchored in the ground and connected to hoopings (8) joining the posts (6) to each other by anchoring means (24).

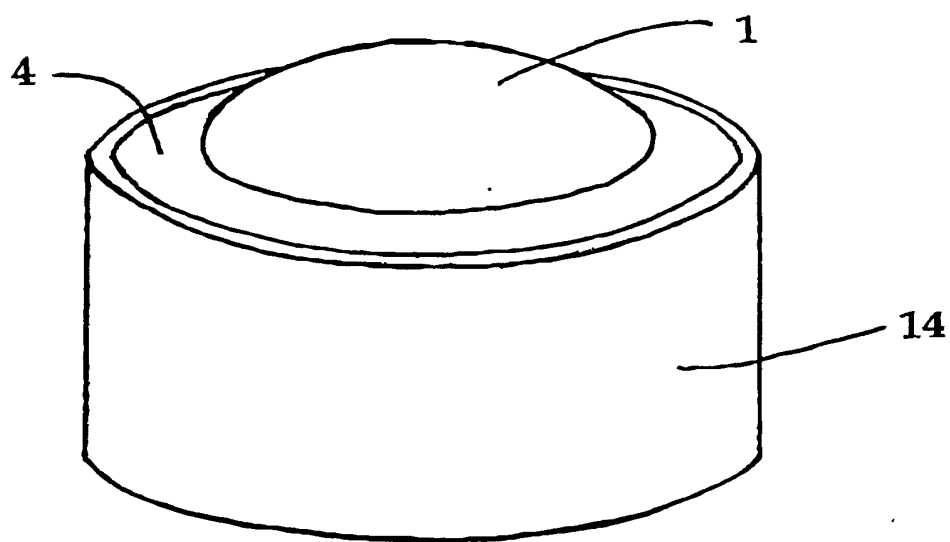
4. The device according to Claim 1, characterized in that the casing (14) comprises a structure (10) comprising posts (6) anchored in the ground and comprising hoopings (8) joining the posts (6) to each other, and that a metallic trellis covered with concrete or the equivalent is fixed on this structure.

5. The device according to Claim 1, characterized in that the casing (14) comprises elementary blocks (18) such as large concrete bricks, at least some of which are arranged in fives, that the blocks are connected by bars (20) traversing them, and that the unit is erected on the ground.

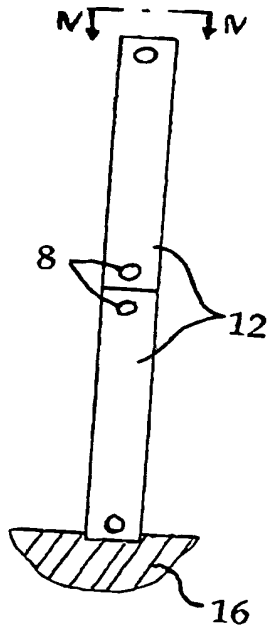
6. The device according to Claim 5, characterized in that the elementary blocks (18) of the casing (14) and traversed by the bars (20) are also prestressed.



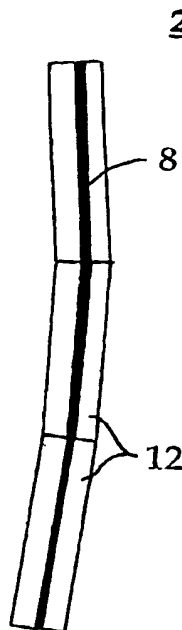
**FIG. 1**



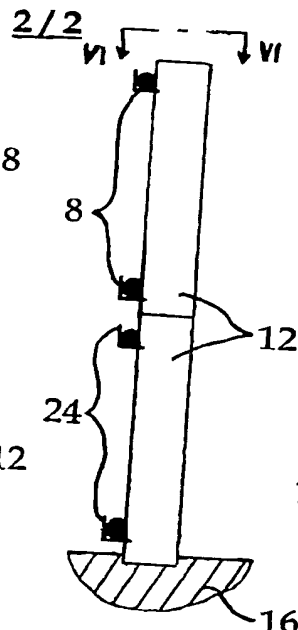
**FIG. 2**



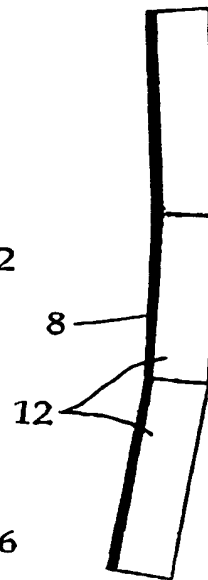
**FIG. 3**



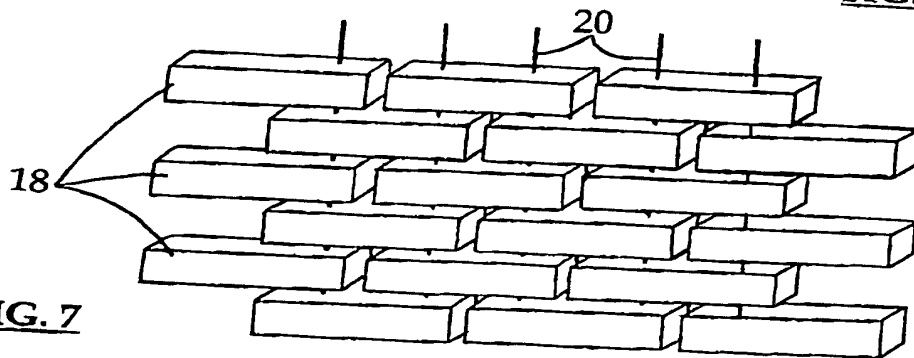
**FIG. 4**



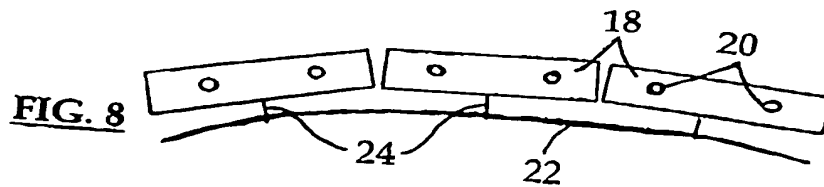
**FIG. 5**



**FIG. 6**



**FIG. 7**



**FIG. 8**